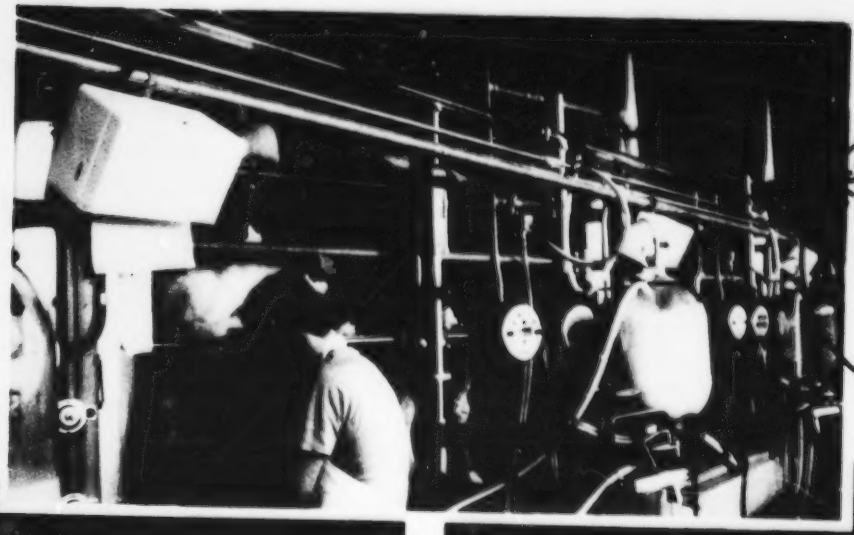
CA2ALA 170
A56
1985-86 c.2



LATURE LIBRARY
MAR 29 1989
EDMONTON

The Alberta Agriculture Research Trust 1985-1986

Annual Report

89-02828/

The Alberta Agricultural Research Trust 1985-1986

The research function is responsible for sourcing or developing the information and techniques which lead to advances in agricultural technology. It is the keystone of any coordinated campaign to improve and ensure the long term viability and profitability of the farm economy. Therefore it is incumbent on us to marshal our research resources, including scarce dollars, in a cooperative effort to develop agricultural technology.

Two years ago the Board of Trustees of the Alberta Agricultural Research Trust adopted a significant change in policy requiring all new AART projects to obtain a portion of their funding from the private sector. In 1985-86 that policy came into effect. Total cost of the 30 projects funded during the last fiscal year (7 renewals and 23 new) was $525,303. Significantly, more than 40% of the project funding, $213,039, originated with the private sector. The Board of Trustees of the AART continues to encourage an increasing involvement by agri-business.

Private enterprise must continue to be a full participating partner in this joint venture. In 1966 Alberta Agriculture provided the base funding for the Alberta Agricultural Research Trust with an initial $500,000 operating grant. The department has continued this commitment with year-by-year infusions of $250,000 to support research projects.

To date the Trust has approved, in total, about 350 projects with $5.8 million in funding support. The Board arrives at these decisions through a number of operating guidelines, but one above all is crucial: *all research supported by the AART must be relevant to Alberta's agriculture industry.* The Board believes that it has kept this commitment.

On behalf of the Board of Trustees of the Alberta Agricultural Research Trust, I extend our appreciation to the participating research scientists, to the Grants Committee and to those organizations and businesses which continue to provide financial support to agricultural research in Alberta.

H. B. McEwen
Chairman, Board of Trustees

H. B. McEwen, Chairman
Deputy Minister, Alberta Agriculture

Dr. R. T. Berg, Secretary
Dean, Faculty of Agriculture and Forestry

Dr. D. Currie
Alberta Research Council Representative

Mr. P. Dooley
Unifarm Representative

Mr. J. Iwabushi
Agri-business Representative

Mr. A. Johnstone
Agri-business Representative

Dr. J. Mahone
Alberta Agriculture Representative

Mr. L. Quantz
Alberta Institute of Agrologists Representative

Mr. J. Riddle
Unifarm Representative

Mr. A. Smith
Agri-business Representative

Mr. B. Thorlakson
Agri-business Representative

Dr. F. Wolfe
University of Alberta Representative

Dr. M. H. Hawkins, Chairman
University of Alberta

Dr. J. Robertson, Vice-Chairman
University of Alberta

Dr. T. Church
Alberta Agriculture

Mr. E. Rapp
University of Alberta

Dr. J. Helm
Alberta Agriculture

Dr. N. C. Rawlings
Western College of Veterinary Medicine

Dr. D. E. Waldern
Agriculture Canada

AGRICULTURAL ENGINEERING

DOMIER, K. W.; W. T. ANDREW

A systematic study of potato cutters, seed pieces and planters

Reducing the variations in hill to hill yield and improving the uniformity of potato planting patterns depends largely on homogeneity of physical attributes in seed pieces within seed lots.

The mass and shape of seed pieces are important agronomic considerations since uncut surface area is proportional to the number of stems produced, and the number of stems per unit mass is a primary factor in determining yield. From a mechanical point of view, seed piece size and shape provides a means to access seed piece compatibility with elements in the planter's metering mechanism. An increase in the number of successful metering events is consistent with a more uniform planting pattern.

To determine the extent and causes of variations in physical characteristics of seed pieces, a seed piece survey was conducted on potato farms in the Edmonton area and on irrigated farms in southern Alberta. In total, 18 whole and cut seed samples were obtained and analyzed. Seed pieces cut from seed potato lots with a low mean weight and standard deviation were more uniform in size, had less variation in shape, and had a higher cut surface area/total surface area ratio. Further studies in planter-seed piece interaction and the development of performance feedback mechanisms for both cutters and planters would greatly improve the efficiency of potato planting operations.

Industry support for this project was provided by the Alberta Potato Commission.

ANIMAL SCIENCE

AHERNE, F.X.; T. VAN LUEN

A study of the potential of increasing the reproductive efficiency of gilts

A total of 120 gilts were assigned to various boar exposure treatments. These treatments consisted of: moving a boar to a pen of gilts for 30 minutes per day, moving a pen of gilts to a boar in his pen for 30 minutes per day, moving a boar to a pen of gilts for 24 hours per day, moving a pen of gilts to a pen of 4 boars for 30 minutes per day, or no boar exposure (control). All gilts were fed ad libitum. At 140 days of age the gilts were mixed and housed in pens of four at which time boar exposure was initiated. All boar exposures were for a 10 day period. Gilts were observed daily for signs of estrus. The gilts were slaughtered 10 days after exhibiting standing heat at which time ovaries were removed and examined to verify ovulation. All gilts not showing signs of heat by 270 days were slaughtered. Age, weight and ovulation rate at first estrus were similar for all treatments. The percentage of gilts reaching estrus before 270 days of age was higher ($P < 0.05$) for the gilts to boar and the 24 hour exposure treatments than for gilts on the control treatment.

Industry support for this project was provided by the Alberta Pork Producers Marketing Board.

MATHISON, G.W.; L.P. MILLIGAN

Evaluation of aspen as a feedstuff for ruminants

The digestibility and voluntary intake of diets containing high percentages of ground, whole aspen trees were measured for sheep and cattle. The dry matter in a diet containing a mixture of 58% hay and 42% aspen (dry matter basis) was 53% digestible in cattle and 49% digestible in sheep. Digestibilities of the aspen component were calculated to be 37 and 31%, respectively. Corresponding calculated digestible energy values for the aspen were 6.4 and 4.2 MJ/kg dry matter. A higher digestibility for cattle than for sheep diets was also measured when a silage made from aspen and barley grain was evaluated in this project. Cattle voluntarily consumed 6.0 kg of dry matter daily when the aspen-hay diet was fed. This level of intake (1.5% of body weight and 66 $g/kg^{.75}$/day) was 77% of the intake achieved by cattle when only hay was fed. Sheep only ate 61% as much of the aspen-hay mixture as they did when the hay was fed. These intakes and digestibilities meant that the diet containing 58% hay and 42% aspen was not quite adequate for maintenance when fed ad libitum to cattle. Sheep met only 75% or less of their maintenance requirements when given this diet. Dry matter disappearances of 25 and 42% were measured in a 72 hour period for ground aspen and for aspen/barley grain silage, respectively, using the in situ bag technique. The rate of degradation of aspen fibre in these bags was estimated to be .003 h^{-1} which is only about one-tenth the degradation rate expected with poor quality forages. It was concluded that the feeding value of unprocessed aspen in ruminant diets is less than 75% of the feeding value of straw. This limited usefulness was found to be due to a low potential digestibility and a low rate of degradation in the rumen as well as to low voluntary consumption by cattle and sheep.

Industry support for this project was provided by the Coban Institute.

MATHISON, G.W.; L.P. MILLIGAN

Effect of lasalocid on the energetic efficiency of cattle

The influence of lasalocid on the feedlot performance of cattle fed diets containing 90% concentrate was examined and compared to that of monesin in a trial with 100 growing-fattening heifers. Heifers fed lasalocid grew an average of 9.7% faster than control animals and had a 9% better feed conversion efficiency. Comparable values for monesin fed heifers were 4% and 6%, respectively. Lasalocid caused decreases in methane and fecal energy losses of 5.3% and 7.7%, respectively. These decreased energy losses cumulatively resulted in a 7% increase in the metabolizable energy content of the diets supplemented with lasalocid which accounted for the majority of the improved performance noted with the ionophore in the feeding trial. No significant differences were detected in the plasma concentrations of growth hormone, insulin or glucagon due to the addition of the ionophore to the diet. It was concluded that the main method by which ionophores improved the feed conversion efficiency of feedlot animals was through a combined effect on digestibility and on methane losses, with changes in digestibility being the more important of these two factors.

Industry support for this project was provided by Hoffman-Laroche.

SAUER, W.C.

The biological availability of biotin in feedstuffs for pigs

Six growing pigs were fitted with a T-cannula at the end of the small intestine to determine the digestibility of biotin in soybean meal, meat-and-bone meal, canola meal, barley, corn and wheat. There was a large increase, representing the minimum amount of biotin synthesis by the microflora in the large intestine, between ileal digesta and feces. With the exception of the canola meal diet, the increase exceeded the dietary intake. With the exception of biotin in soybean meal, of which 55% was absorbed, there was practically no absorption of biotin from the other feedstuffs in the small intestine. Determined over the entire digestive tract, practically none of the biotin in meat-and-bone meal, canola meal and barley but all of biotin in corn and 95 and 62% in wheat and soybean meal, respectively, were absorbed. These studies point to the low digestibility of biotin in certain feedstuffs and the large amount of biotin that can be synthesized by the microflora in the large intestine.

Industry support for this project was provided by Hoffman-Laroche.

SAUER, W.C.

Evaluation of the nutritive value of canola meal for pigs by aid of the modified nylon bag technique

Studies were performed to determine the optimum conditions under which the mobile nylon bag technique should be used to determine the protein digestibility in canola meal. The closest agreement between results obtained by mobile nylon bag technique and conventional studies occurred with a pre-digestion time of 4 hours, a pre-digestion solution with pH 2 and pepsin activity of 377.4 I.U. per litre, nylon mesh with pore size 48, 63 or 70 and sample size 0.5 or 1.0 g. Under these conditions the protein digestibility in canola meal ranged from 77 to 80% compared to 79% in conventional studies. Further studies were carried out to determine the protein digestibility in canola meal as affected by variety (or strain) and location. Depending on location and variety (strain), the protein digestibility ranged from 76 to 88%. The protein digestibility was lowest in Candle. In other studies the protein digestibilities in canola meal with "promising genetic material" ranged from 79 to 83%. These studies show the feasibility of mobile nylon bag technique for rapid determination of protein digestibility in canola meal.

Industry support for this project was provided by the Canola Council of Canada.

THOMPSON, J.R.

Etiology of development of leg weakness in swine

The etiology of the development of leg weakness in pigs arising from connective tissue disorders was explored in a series of experiments comprising five separate studies. In Studies One and Two, it was established that severely osteochondrotic cartilage from the joints of lame pigs has a number of biochemical abnormalities in the ground substance proteoglycans. The concentration of proteoglycans was decreased and the proteoglycans were relatively smaller and less able to aggregate in severely diseased cartilage. The size of chondroitin sulfate molecules in the proteoglycans was also reduced. It is suggested these factors will reduce the water binding capacity and thus the compressive strength of this tissue. In Study Three synovial fluid from the joints of lame pigs was found to contain both hyaluronic acid and chondroitin sulfate in amounts similar to that observed in fluid from normal joints. In the fourth study, blood flow to hind limb bones and joint cartilage from 10 to 20 week old pigs was measured. Significant age-related changes in blood flow were measured, however, no significant differences in blood flow were found between areas of cartilage associated with relatively low incidences of osteochondrosis. In Study Five the concentration of the collagen cross-link, pyridinoline, was found to increase 15-fold with increasing animal age from 4 weeks before birth to 30

weeks in tibial joint cartilage. These studies provide unique basic information required for the development of an understanding of the metabolic factors regulating the development of leg-weakness in pigs.

Industry support for this project was provided by the Alberta Pork Producers Marketing Board.

THOMPSON, J.R.

Collagen cross-bridging and the role of prostaglandins in the development of normal and diseased pig joint cartilage

Three studies were performed emphasizing the relatively chemical and heat stable molecule, pyridinoline, associated with cross-linking of collagen molecules in connective tissues. In Study One, pyridinoline concentration increased with age to 1.5 years and remained relatively constant thereafter in stifle joint femoral condyl cartilage pigs. The concentration was significantly lower in severely osteoarthrotic cartilage from lame pigs. In Study Two, the intra-articular weight-bearing semilunar menisci of the stifle joints of pigs were characterized in terms of the distribution of pyridinoline and glycosaminoglycans. The concentration of both constituents was greatest in parts of the menisci subjected to the greatest compressive forces. Studies One and Two demonstrate for the first time a molecular basis for differences in compressive and tensile strength in normal and diseased joint tissues. The third study reports the presence and age related changes in pyridinoline concentrations in connective tissue collagen of the longissimus dorsi muscle. Pyridinoline concentration increased with pig age from 4 weeks before birth to 4.4 years, while collagen solubility decreased, providing evidence of a chemical basis for the increased contribution of collagen to meat toughness with animal age.

Industry support for this project was provided by the Alberta Pork Producers Marketing Board.

YOUNG, B.A.

Climatic influences on nutrition in cattle

The heat required to raise the temperature of ingesta to body temperature has been ignored as a component in winter feeding of cattle. Clearly, practical situations exist where this component places a significant thermal load on animals and therefore on productivity. This project showed that the extent of cooling and the relative contribution to reduced productivity was influenced by the quantity and rate of cooling, as well as by the physiological state of the animal and the ambient temperature. Understanding of the interactions between the animal and ingesta-induced cooling allows for the adoption of feeding systems to minimize the impact on productivity. For example, a thermal-stable, large, well-insulated animal on a high feeding level may, without ill effect, tolerate large single meals of cold ingesta, whereas smaller, poorly-insulated stock suffer unless small quantities of dried feed are offered over an extended daily feeding period.

FOOD SCIENCE

LE MAGUER, M.

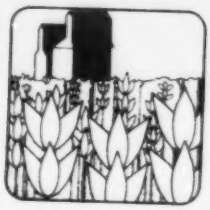
Determination of the surface properties of biologically active immobilized molecules

The following results were obtained:

1. Measurement of hydrophilic sites on the products were found to be in the range 30 to 70 mole/g of support.
2. The external surface area of the particle corresponds to about 0.0214 m^2/g of support. The surface area from nitrogen measurement is about 5 m^2/g. This indicates that the support is substantially porous with 99.6% of the surface area on the inside of the particle.
3. Upon subsequent treatment with the active molecules it appears that only the ones fixed on the external surface of the particle are able to be active. On the basis of the external surface area the amount of active molecules attached to the surface would be about .34 mole/g support. Chemical analysis shows a value of 0.5 mole/g support.

It is clear from the study that an alternate support with larger pores is required. This would allow for a higher concentration (more active molecules/g of support) and a greater activity (more accessible because of larger pores) of the active molecules.

Industry support for this project was provided by Chembiomed.



PLANT SCIENCE

ANDREW, W. T.; DOMIER, K. W.

The integration of seed pieces, cutters and planters for better plant stands in potato fields

Performance characteristics of cup type and pick type potato planters were compared according to the distribution pattern of seed placement. Their performance was observed by varying planter space settings, planter speed, cadaver and size and shape of the seed. Seed placement was measured over a distance of 50 metres. Seeds classified as singles, doubles, misses and double misses were observed for each of the variables. There was a higher percentage of singles in case of the pick type planter while there were more doubles in case of the cup type planter. In general, end pieces gave a higher percentage of singles and more consistent results than center cut pieces.

HIRUKI, C.

Serological and anatomical studies on plant mollicutes diseases with special reference to their diagnostic value

The objective of this project was to develop highly specific and dependable diagnostic procedures for plant mollicutes diseases. The advantages of using fluorescence microscopy in the histochemistry of mycoplasmalike- organisms (MLO) infection of plants are its high sensitivity and its wide-ranging applicability to cellular substances which may be detected either directly or after certain chemical treatments. Aniline Blue test is useful in locating MLO infected cells with abnormal deposition of callose. The specific binding of a fluorochrome, 4' 6-diamidino- 2- phenylindole.2HC1, with MLO-DNA was detected by staining hand-sections of stems and petioles of MLO-infected plants after glutaraldehyde fixation. This simple and practical method is useful for rapid diagnosis of MLO infection as well as selecting disease-free stock materials from a large number of samples suspected to be infected by MLO. Antisera prepared against four MLO isolates reacted specifically with the mycoplasma antigens in the hand sections in indirect immunofluorescence microscopy. This method permitted highly specific detection of MLO in infected tissue specimens and is thus useful for field disease diagnosis. This is the first report of MLO detection in the plant tissue by means of indirect immunofluorescence microscopy.

TOOP, E.W.; E.E. MARAHRENS

The effect of substrate on the rooting of Begonia x lucerna cuttings

In a project designed to produce compact pot plants of Begonia x lucerna it was observed that the type of rooting media and the amendments that it contained had a profound effect on root formation. Therefore rooting experiments were conducted in three repeated trials using seven rooting media.

The best root systems developed in peat-vermiculite and peat-perlite mixes amended with super-phosphate and calcium nitrate. These cuttings developed strong main roots and very extensive fibrous branching. Fresh and dry weight of roots were the highest and shoot growth was the best using these media.

Vermiculite alone and perlite alone resulted in shorter and thicker roots without a large fibrous mass. Fresh and dry weight of roots were the lowest in these media. Shoot growth was short and chlorotic, particularly in perlite.

Peat-vermiculite mix amended with dolomite lime only and unamended sand-peat-mix resulted in roots inferior to those from media with fertilizer, but superior to those in vermiculite and perlite alone. The roots in sand-peat were particularly short and fibrous and the shoots were short, but of good color.

Peat-vermiculite mix with slow release fertilizer (Osmocote 14-14-14) was the only medium in which Botrytis cinerea killed cuttings in each replication.

Industry support for this project was provided by the Cecil Delworth Foundation and Flowers Canada.

VANDEN BORN, W. H.

Biology and control of cleavers

Moderate to severe localized infestations of false cleavers (Galium spurium L.) were found in many rapeseed and grain fields throughout central Alberta and the northern and eastern parts of the Peace River region. Seedling emergence was observed from early May to late September. Marked differences in dormancy were observed among seed lots collected from 48 locations in the province. Seed germination was inhibited in the presence of light. False cleavers plants produced as many as 1500 seeds per plant, and even very light infestations in rapeseed resulted in unacceptable levels of contamination in harvested seed.

Fair to good selective control in rapeseed was obtained with TREFLAN (trifluralin) and SONALAN (ethalfluralin). In cereal crops, a greater variety of selective herbicides can be used to control false cleavers and it is recommended, therefore, that a grain crop be planted for at least two consecutive years in fields that have false cleaver infestations.

WALTON, P.D.

The combining ability of alfalfa clones

Three 8 x 8 diallel crosses, two in the field and one in the glasshouse, were employed to study the gene action and stability of dry matter yield in eight alfalfa clones which were previously selected for their resistance to "alfalfa sickness". From 1982 to 1984, nine forage harvests were made from the two field diallel crosses. These represented different environments for which an Eberhart-Russel stability analysis of clonal performance was conducted. A fourth experiment, in the glasshouse, compared the performance of resistant and susceptible strains in sterilized and unsterilized "sick" soil. Both glasshouse tests were evaluated for plant height, leaf weight, leaf area, total dry weight, specific leaf weight and root necrosis.

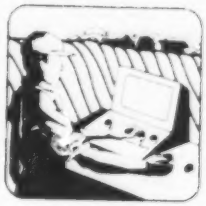
Griffing's analysis of the field diallel crosses indicated that additive gene action was important in determining dry matter yield among the alfalfa clones. The clones were evaluated for dry matter yield, general combining ability and stability with a view to selecting suitable clones for inclusion in a synthetic strain. It is recommended that clones 2G169, 2B76 and 1VP9 with high dry matter yield and general combining ability, constitute parental clones for the new strain. Clone 2B29 with average dry matter yield and general combining ability should be included as a fourth parent to maintain a broad genetic base and prevent inbreeding depression in advanced generations of the new synthetic.

The glasshouse diallel, grown in alfalfa sick soil, indicated that previous selection had depleted additive genes and success in further selection for decreased root necrosis could not be expected. There is a need to identify the pathogens and environments which cause and enhance "alfalfa sickness" so that these may be employed to increase selection pressure in a breeding programme.

Strains previously selected for their resistance to alfalfa sickness had larger leaf areas and higher leaf weights than susceptible strains. Resistant strains could therefore be expected to exhibit superior net assimilation rates. All the resistant clones were stable with mean square deviations not significantly different from zero.

Industry support for this project was provided by the Alberta Wheat Pool.

RURAL ECONOMY



BAUER, L.; M. L. LEROHL

An economic analysis of land ownership versus land leasing arrangements connected with livestock production in Alberta

The study consisted of an analysis of the costs and returns of cattle production associated with various lease-land, owned-land combinations by regions of the province of Alberta. A simulation model was used to trace the effects of different owned-lease land combinations for different representative operations in livestock production costs and returns. Representative operators were characterized as large, midsize and small for the northern, central and southern regions of Alberta and divided between lease and no-lease types of operation.

Net receipts per animal unit sold generally decrease with decreasing enterprise size except for the southern midsize operations which are greater than the southern large operations. They are also larger for non-lease operators than for full-lease operators with the exception of the northern midsize operators. However, full-lease operators show slightly to considerably higher total annual net receipts than non-lease operators with the exception of southern small operators. There is little doubt that lease land is of considerable importance to operators in most categories. Simulated partial and complete removal of lease land results in substantial reductions in total annual receipts.

Industry support for this project was provided by the Alberta Cattle Commission.

SOIL SCIENCE

NYBORG, M.

Big pellets and deep bands

The purpose of this field experiment was essentially to compare for barley yield, or for barley nitrogen uptake, the fall and spring application of nitrogen fertilizer (urea). Other variables were incorporation, banding, and nest placement; shallow and deep placement; and straw removal versus straw retention. There were two field experiments, but one was lost through flooding with the 1983 heavy rains. The other experiment showed wide differences among the different ways of applying the fertilizer. The retention of the straw of the previous crop reduced the amount of yield increase from the fertilizer incorporated into the soil. Considering only treatments where the straw was removed, fall application gave the highest yield increase with nest placement, followed by banding, and followed by incorporation. Deep banding or deep nesting (15 cm) was slightly superior to the shallow banding or nesting (7 cm). The fall application of nests gave the highest yields among the various fall and spring methods, and among the spring applications incorporation (in the 0-15 cm depth) yielded the most. Yield increase from fertilizers were in agreement with increase of nitrogen uptake. This one field experiment was in general agreement with other similar, but simpler experiments conducted previously.

Industry support for this project was provided by Western Co-operative Fertilizers.

NYBORG, M.

Conversion of thiosulphate and sulphur emulsion to sulphate

Fertilizers which contain sulphates (especially ammonium sulphate) have been commonly and successfully used for sulphur fertilizer in the prairie provinces. The great advantage of sulphates is that they are immediately available to crops. Elemental sulphur is now also used as a sulphur fertilizer, but it needs to be converted to sulphate by the soil before it is available to crops. In our investigation the rate of conversion was measured for two commercial elemental sulphur fertilizers in which fine particles of sulphur were held together in granules by a clay (bentonite). Also included was a commercial elemental sulphur fertilizer made of extremely fine sulphur particles (less than 10 microns) held in an emulsion. The fertilizers were incubated for up to 42 days under ideal soil temperature and moisture content. The clay-held elemental sulphur fertilizers were not converted by 42 days. Sixty percent of the emulsion fertilizer was converted by 42 days when mixed into the soil, but much less when placed in bands. The crop availability of ammonium thiosulphate solution fertilizer was compared to that of a usual sulphate fertilizer in field experiments. The ammonium thiosulphate solution fertilizer was only 14% as available as was sulphate fertilizer, but the fertilizers were placed in bands. We concluded that elemental sulphur emulsion, and the ammonium thiosulphate solution fertilizer, were slowed in their conversion to sulphate when banded.

Industry support for this project was provided by Western Co-operative Fertilizers.

ROBERTSON, J.A.; D.C. PENNY; R.J. LABBE

Factors affecting potassium availability in central Alberta soils

Four experiments were conducted from 1979-1984 at 23 sites in central Alberta. Many of the sites were poorly drained and formed on coarse-medium textured fluvial material. Barley was used as the test crop.

We found that there was a fairly high probability of a yield response when extractable-K levels were less than 40 ppm and some possibility of a response when extractable-K was 41-80 ppm. The present "critical" value of 125 ppm for cereal crops was low enough to identify most K-deficient soils.

High initial applications of K eliminated response to annual banded applications for at least two years but do not appear to be economic. Much of the K added in the high initial applications could not be identified in subsequent years by the usual soil-test methods.

Chloride ion in KCl appeared to result in small yield increase and, in some cases, a lower disease incidence. Much more work is needed on this topic.

We did not find that the need for K fertilization was greater with early-seeded than late-seeded crops.

Industry support for this project was provided by Cominco, Potash Corporation of Saskatchewan and Potash & Phosphate Institute.

WEBSTER, G.R.

Testing of a revised soil moisture budget

This was a cooperative project with Professor Collis-George, University of Sydney, Australia who is a soil physicist of world stature. He undertook a critical review of the "weather term" in a yield production function that our research team developed. Our weather term currently includes evapotranspiration, potential evapotranspiration, a daily soil moisture budget and plant stress days.

VETERINARY MEDICINE

BARTH, A.

A study of fertilization rates of semen from bulls with various levels of sperm defects

a) Cases of infertility due to the "knobbed sperm" defect have previously been reported in the Friesian breed in Europe. A similar defect as determined by light and electron microscopy has been found in the Charolais breed in Canada. The acrosome defect was found to persist at very high levels (60 to 100 percent of spermatozoa) for extended periods of time in seven Charolais bulls. A severely affected Charolais bull was placed in a competitive mating situation with two other bulls. The results of the breeding trial showed that the knobbed acrosome defect in Charolais bulls severely depresses fertility when the defect is present in high proportions of spermatozoa. A pedigree study done on five affected bulls showed that three of the bulls had a common grandsire.

b) Two main types of nuclear vacuolation have been observed: small single apical vacuoles and multiple vacuoles which usually occur in a ring at the equatorial region of the nucleus ("diadem defect"). Two breeding trials using superovulated heifers were designed to study the significance of nuclear vacuolation on fertility. Heifers were slaughtered after superovulation and breeding, the reproductive tracts were recovered and embryos were flushed from the reproductive tracts and evaluated for fertilization and normal development. The results showed that nuclear vacuolation of spermatozoa is detrimental to fertilization and embryonic development. The tolerable level of nuclear vacuolation appears to be less than 20 percent of affected spermatozoa.

Industry support for this project was provided by the Canadian Animal Breeders Association.

FORSYTH, G.W.

Control of intestinal secretion in colibacillosis in pigs

In the course of this research two different approaches to controlling excessive intestinal fluid secretion were investigated. The first approach was based on the involvement of intracellular second messenger compounds as physiological regulators of fluid absorption and secretion by the intestinal mucosa. Cyclic AMP concentrations in intestinal epithelial cells were reduced by activating cyclic nucleotide phosphodiesterase with imidazole or by inhibiting adenylate cyclase with deoxyadenosine derivatives. Intestinal secretion rates induced by exposure to bacterial enterotoxins were not reduced even though cyclic AMP concentrations were depressed below basal levels. We conclude that it is probably not feasible to inhibit intestinal secretion by pharmacological manipulation of second messenger concentrations.

The second approach to reducing excessive intestinal fluid secretion employed a series of weak organic acids. These acids were introduced into intestinal loops via surgical procedures, or in one trial were given orally to baby pigs. Weak organic acids such as nicotinic or glutaric acids given under controlled concentration and pH conditions were effective in reducing intestinal secretion, and would appear to show some promise as treatments for colibacillosis diarrhea.

Industry support for this project was provided by the Veterinary Infectious Disease Organization.

RAWLINGS, N.C.

The development and application of controlled breeding and artificial insemination in sheep

The breeding season was 157, 154, <126, 210 and 217 days for Rambouillet, Columbia, Suffolk, Rambouillet x Finn and Columbia x Finn ewes respectively. The addition of pregnant mare serum gonadotropin following estrous synchronization with progestin containing intravaginal sponges did not affect fertility, but did affect the timing of estrus and the hormone changes that cause ovulation. Exposing the purebred ewes to 18 hours of daylight in January, decreasing by 30 minutes a week subsequently improved fertility to breeding in May. Crossbred ewes produced most lambs and their fertility was high following May breeding, with or without daylight manipulation. A simple restraining device for ewes allowed the collection of semen from rams. Libido varied, but all rams could be collected this way, without the trauma of electroejaculation. Many of these techniques are now being used in a scheme to examine the economics of intensified fat lamb production, using reproductive management.

STOCKDALE, P.H.G.

Immunological control of shipping fever in cattle

The project was to be done in two phases. In the first phase herds of beef cattle free of IBR virus (BHV-1) and *P. haemolytica*, the bacterium most commonly associated with "shipping fever", were to be identified. In the second and third phases a *P. haemolytica* sub-unit vaccine was to be tested for its ability to produce an immune response and to resist challenge by experimental shipping fever.

a) Identification of specific pathogen free cattle

Eighteen individuals, whose ranches were relatively isolated and had no recent record of cases of bovine pneumonia, agreed to co-operate with the researchers. Ranches were visited on branding

day and blood samples and nasal swabs taken from 10% of the current year's calves. The nasal swabs were cultured for *P. haemolytica* by planting on fresh blood agar. The blood samples were examined for antibodies against BHV-1 using the serum neutralization test and against *P. haemolytica* using the haemagglutination inhibition test. Four of the eighteen herds tested contained cattle from which no organisms were isolated and their sera contained no or very low titres of antibody to either of these diseases.

Three calves each from the two farms that were considered would have the most susceptible cattle were purchased. The calves were again bled to check for serum antibodies and were swabbed intranasally to check for *P. haemolytica*. The calves were then given an aerosol of BHV-1 virus followed four days later by an aerosol of *P. haemolytica*. The three calves from the first farm died within 36 hours of the P. haemolytica aerosol. One calf from the second farm died within 72 hours, and a second calf within 96 hours, after the same aerosol. Twelve more calves were bought from the first farm. The calves were given an aerosol of BHV-1 as before. On day 4 after the first aerosol twelve calves divided into four groups were given varying doses of *P. haemolytica* in the following amounts 1×10^3, 1×10^5, 1×10^7 and 1×10^9 so that each dose was given to three calves.

b) Vaccination against bovine pneumonic pasteurellosis with an extract of P . *haemolytica*

Fresh colonies of P. haemolytica grown on blood were treated with potassium thiocyanate (KSCN) and the resulting extract was dialyzed. This antigen was used as an immunizing agent against pneumonic pasteurellosis.

A total of thirty-six calves were used in three experiments. In experiments A and B, twelve calves per experiment were divided into three equal groups. The first group was vaccinated with an aerosol of the KSCN extract intranasally, the second group was vaccinated subcutaneously with the same extract and the third group of calves were untreated controls. In experiment C, six calves were vaccinated intramuscularly and six were left as controls. Approximately one month after vaccination all calves were challenged with an aerosol of BHV-1 (Isolate 108) followed four days later by an aerosol of *P. haemolytica* type A1. Protection against subsequent development of experimental pneumonic pasteurellosis in cattle was seen in the vaccinated calves when compared to the control calves.

Industry support for this project was provided by the Veterinary Infectious Disease Organization.

UNIVERSITY OF SASKATCHEWAN

BLAIR, R.; B. N. MITARU

Canola meal for starter and grower pigs

A series of experiments was conducted to determine the optimum level of inclusion of canola meal in the diets of starter (6-20 kg) and grower (20-60 kg) pigs. The project was a collaborative one between the Universities of Alberta and Saskatchewan.

In the Saskatchewan study, a total of 1025 starting pigs and 160 growing pigs was used, under practical conditions. Canola meal appeared to be less palatable than soybean meal and the effect was more pronounced with younger pigs. It was found that no more than 10% of canola meal could be used to replace soybean meal in the diet, otherwise feed intake and growth were reduced.

Industry support for this project was provided by the Canola Council of Canada.

CONTINUING GRANTS

Date following title identifies Annual Report in which project description appears.

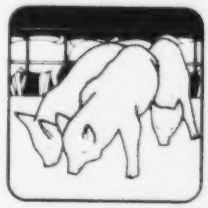
AGRICULTURAL ENGINEERING

HARRISON, H.P.
Investigation of a bent legged plow (1984-1985)

RAPP, E.
Evaluating drainage feasibility of some Alberta Soils (1972-1973)

RAPP, E.
Irrigation scheduling for supplemental irrigation in central and northern Alberta (1979-1980)

ANIMAL SCIENCE



AHERNE, F.X.
The effects of energy and protein intake after weaning on the reproductive performance of sows (1984-1985)

AHERNE, F.X.
The effect of flavor additives on the utilization of canola meal by starter pigs 4-8 weeks of age (1984-1985)

BERG, R.T.
Influence of selection for growth on maternal traits of mice (1982-1983)

BERG, R.T.; M.A. PRICE; R.T. HARDIN
Strategies for beef cattle improvement (1980-1981)

MILLIGAN, L.P.; P.M. KENNEDY
Effects of soluble and bypass protein supplements on intake and utilization of straw (1981-1983)

MILLIGAN, L.P.; P.M. KENNEDY
Methods of protection of canola meal (1982-1983)

SAUER, W.C.
Lysine requirements of starter pigs (1981-1982)

SHIRES, A.
Effects of variable levels of dietary protein and energy and periods of feeding on the rate of growth and carcass composition of meat-type chickens (1982-1983)

THOMPSON, J.R.; F.X. AHERNE
Etiology of development of leg weaknesses in swine (1981-1982)

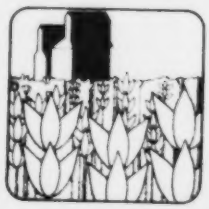
FOOD SCIENCE

OORAIKUL, B.
Food sauce from canola meal (1984-1985)

WOLFE, F.H.
Calcium activated neutral protease levels in PSE pork muscle (1983-1984)

HOME ECONOMICS

HAWRYSH, Z.J.
Quality of restructured beef (1983-1984)



PLANT SCIENCE

HIRUKI, C.
Evaluation and development of practical diagnostic procedures for potato spindle tuber viroid diseases in Alberta (1982-1983)

KNOWLES, R.H.
The behaviour of turfgrass growing on minimal medium in response to irrigation and nutritional inputs (1980-1981)

KONDRA, Z.P.
Clonal propagation of canola (1984-1985)

TEWARI, J.P.
The effects of polyoxins B and D on Alternaria brassicae and the Blackspot of rapeseed (1975-1976)

RURAL ECONOMY

HAWKINS, M.H.
Transportation costs for Alberta hogs (1984-1985)

LEROHL, M.L.
Effects of domestic grain grades on the operating efficiency of Canada's west coast terminal elevators (1983-1984)

PETERSON, T.A.
Analysis of farm leases and rental arrangements in Alberta (1980-1981)

RICHTER, J.J.
The European agricultural export subsidy and the prospect of the Canadian grain trade (1981-1982)

SCHULTZ, W.M.
Financial planning models for Alberta farms (1981-1982)

SOIL SCIENCE

MacHARDY, F.V.
Assessment of nitrogen contribution to cereals by intercropping with annual legumes (1977-1978)

MacHARDY, F.V.; F.D. COOK
Measurement of photosynthate requirement for nitrogen fixation by selected free-living microorganisms found in Alberta soils (1977-1978)

McGILL, W.B.
Acid phosphatase production in relation to plant-available P (1981-1982)

NYBORG, M.
Elemental sulphur and nitrogen fertilizers (1983-1984)

PLUTH, D.J.
Productivity ratings for soil types in Edson and Whitecourt map areas (1968-1969)

PLUTH, D.J.
Nutrient distribution and cycling in selected forest ecosystems (1968-1969)

WEBSTER, G.R.
Testing of a revised soil-moisture budget (1978-1979)

INTERDISCIPLINARY

BERG, R.T.; Z.J. HAWRYSH; M.A. PRICE
Assessment of optimum slaughter weight and condition in beef cattle (1979-1980)

CLEGG, L.F.L.; W.T. ANDREW
Fertilizer and trace element studies (1974-1975)

ROBERTSON, J.A.; K.W. DOMIER
Factors affecting P fertilizer utilization in tilled and untilled soils (1982-1983)

UNIVERSITY OF BRITISH COLUMBIA

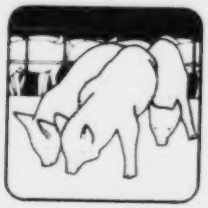
COPEMAN, R.J.
Serological detection methods for Corynebacterium sepedonicum (1977-1978)

VETERINARY MEDICINE

GUDMUNDSON, J.; M.E. SMART
A survey of trace mineral metabolism in purebred and percentage simmental cattle (1978-1979)

MURPHY, B.D.
Improving production by increasing embryo survival in mink (1984-1985)

VAN DEN HURK, J.
Field testing of a cell culture grown vaccine for hemorrhagic enteritis of turkeys (1984-1985)



ANIMAL SCIENCE

AHERNE, F.X.

A study of growth and physiological development of gilts

To determine the relative influences of age, weight and body composition on physiological development and reproductive performance of prepubertal gilts. The proposed research, whilst in itself supplying essential information of direct relevance to swine producers, also provides a foundation on which future research can be planned. The major benefit from these studies will be an insight into the effects of current national selection programs and current feeding and management practices of replacement gilts on physiological development and reproductive efficiency of gilts.

AHERNE, F.X.

An evaluation of the nutritive value of hulless barleys for young pigs

The development of hulless barley cultivars would appear to offer a high energy alternative to barley, wheat or corn in starter-pig diets. However, some hulless barleys have not proven to be better than regular barley in the diets of young pigs. The reason for this may be that hulless barley contains a carbohydrate fraction called β glucan which has a low digestibility for young pigs. However, the deleterious effects of β glucans may be overcome by including in the diets an inexpensive enzyme ("Zymo-Best") which would break down the β glucans to usable products.

The objectives of this study are: (1) To evaluate the nutritive value of two varieties of hulless barley (Scout and Black) using a feeding trial and digestibility determinations. (2) To determine if the addition of Zymo-Best to the hulless barley diets would improve pig performance.

AHERNE, F.X.

The effects of stocking density and floor type on pig performance and leg weakness

It has been suggested that increasing the number of pigs in a pen to 8 leads to social instability, increased aggression, decreased feed intake and reduced growth rate, even if floor space per pig is kept constant.

Others report that up to 24 pigs per pen with constant floor space does not reduce pig performance. The performance of pigs has generally been similar on different types of floors. Small differences in foot and pad lesions have been noted but the long term significance of these to subsequent leg weakness has not been evaluated.

The objectives of this experiment are:

1. To evaluate the effects of stocking density on the performance of weanling pigs.
2. To determine the effects of floor type on pig performance and the incidence of foot lesions from weaning to 20 kg liveweight.
3. To determine the effects of raising pigs from weaning to 100 kg on wire mesh or tenderfoot on the incidence of foot lesions and to determine whether floor type and foot lesions influence the incidence of lameness (osteochondrosis) at market weight (100 kg liveweight).

KENNELLY, J.J.

The mobile nylon bag as a rapid reliable indicator of heat damage in dehydrated alfalfa

The objective of the study is to determine if mobile nylon bags can be used as a rapid indicator of the nutritive value of dehydrated alfalfa.

The current market (export and domestic) for dehydrated alfalfa is worth approximately $15 million annually. If Alberta is to retain or increase its share of current markets for dehydrated alfalfa, quality control is essential. The current price structure is related to protein content. However, research has shown that protein content frequently is not a good indicator of quality because heat damage during processing of alfalfa may render a high proportion of the protein unavailable to the animal. The mobile nylon bag could potentially be used as a rapid, reliable, low cost indicator of the availability of protein and other nutrients in dehydrated alfalfa.

KENNELLY, J.J.

Use of ammonia in the preservation and improvement of nutritive value of barley silage

The objectives of this study are to:

1. Evaluate the efficacy of ammonia as a preservative.
2. Determine if ammoniation improves the nutritive value of barley silage for ruminant animals.

Barley silage is being used by an increasing number of dairy farmers in Alberta. If ammonia is found to be an effective preservative for barley silage it would reduce storage losses in bunker and pit silos which currently can be as high as 30 percent. In addition ammonia can supply a source of low cost nitrogen to ruminant animals and could potentially improve the digestibility of the silage as has been

found for corn silage. The low cost of ammonia and its widespread availability makes ammonia treatment particularly attractive.

PRICE, M.A.

The use of young boars in commercial pork production

Young boars are routinely condemned as unfit for human consumption in Canada, mainly because of the alleged unacceptable incidence of "boar taint" in their meat. As a result young boars are not used for pork, even though their cost of production would probably be 5-15% below that of barrows and gilts. In addition mature (culled) boars must either be castrated or lost to the Canadian industry as a source of manufacturing meat. Boar taint is not detectable by the majority of consumers even in fresh pork: research is needed to establish levels of boar taint, as well as yield and quality estimations in cured and comminuted pork products made from young and mature boars.

SAUER, W.C.

Evaluation of the quality of canola meal as measured by the secretion of the pancreatic enzymes in pigs

The objective of the proposed study is to compare and evaluate the quality of canola meal (in comparison to soybean meal) by measuring the activity of enzymes (chymotrypsin, trypsin, lipase and amylase) secreted by the pancreas of pigs that are surgically modified for the collection of pancreatic juice.

In addition, the ratio of activity of proteolytic enzymes to the amount of protein that is consumed should be lower for protein as its quality increases. As yet, these ratios and their use in the evaluation of protein quality have not been determined in both canola meal and soybean meal. The proposed study should provide further answers on the factors that are responsible for the lower in vitro digestibility of protein and amino acid availabilities in canola meal as compared to soybean meal.

SAUER, W.C.

The contribution of microbial vitamin synthesis in the hindgut to the vitamin supply of the pig

The objective of the proposed study is to determine the contribution of microbial synthesis of vitamins, (with special reference to folic acid and biotin) to the vitamin supply of the pig. The information that is obtained will allow for a basis for accurate supplementation of vitamins to pig diets.

SHIRES, A.

Apparent and true metabolizable energy values of canola meals for chickens and turkeys

The available or metabolizable energy values of feedstuffs for poultry have been reported to vary with age, breed and strain and species but the causes of this variability have not been elucidated. It is proposed to identify and measure the sources of variation and to establish representative metabolizable energy values which can be applied to the formulation of diets for chickens and turkeys of different ages.

FOOD SCIENCE

JELEN, P.

Ultrafiltration of cottage cheese whey for new dairy product use

Continued industrial interest in utilization of cottage cheese whey requires work on practical aspects of whey protein recovery by ultrafiltration. The aims of this project are to evaluate the technical and economical feasibility of an ultrafiltration process for development of a cottage cheese dressing from the protein-rich retentate and utilization of the protein-free permeate in existing fruit drinks. The research objectives are: 1) selection and optimization of an appropriate ultrafiltration process; 2) process modifications for optimum retention of valuable low-molecular nutrient compounds (Ca, P, vitamins); and 3) the development of a suitable formula and processing sequence for the two desired products. This development should increase the human food utilization of valuable nutrients produced by dairy farmers.

LE MAGUER, M.

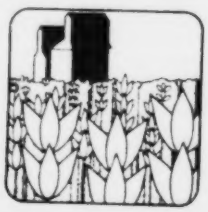
Binding site accessibility of immobilized molecules to large molecules in solution

The objective is to measure binding site accessibility of immobilized molecules to large protein-like components in aqueous solutions. This research will help reduce the cost of these expensive materials to increase application in the food processing area. These materials offer tremendous possibilities in controlling complex reactions responsible for nutritional value, color, flavor and texture of foods.

SPORNS, P.

Monoclonal ELISA analysis for total potato glycoalkaloids

The objective is to develop a rapid test for the very toxic potato glycoalkaloids, solanine and chaconine. This test would aid in breeding and processing the world's fourth most important crop, potatoes.



PLANT SCIENCE

TEWARI, J.P.

Colonization of barley in Alberta by the "biological fertilizers"

The project will attempt to identify the relative susceptibility (or resistance) of barley cultivars, landraces and wild progenitors to the beneficial VAM fungi, make recommendations to the plant breeders and study the interaction between VAM and the common root rot disease of barley caused by Cochliobolus sativus. The information gathered may potentially lead to increased grain yields (through mycorrhizal enhancement of phosphorus uptake and reduced susceptibility to certain pathogens) and reduced fertilizer costs (through increased retrieval of phosphorus from soil).

WALTON, P.D.

Forage productivity from disturbed areas

Strip mining by TransAlta Utilities around Lake Wabamun has disrupted the local ecology of a substantial area. The company is restoring the land and establishing forage crops for hay production and pasture. The objective of this study is to detect farming problems and determine suitable management practices on disturbed lands of this type.

RURAL ECONOMY

CHASE-WILDE, L.J.

Analysis of import demand for malting barley in selected countries

The export market for malting barley has doubled over the last 10 years and is currently more than twice the size of domestic demand. Understanding the determinants of this import demand and related protectionist policies will help Canadian producers and marketers take advantage of existing and future opportunities in the malting barley industry. The proposed research will empirically estimate characteristics of import demand for malting barley and examine implications of results in light of domestic agricultural policies and prospects. Concentration will be given to existing and potential major importers including Japan, other countries in ASEAN (Association of Southeast Asian Nations), and China.

VEEMAN, M.M.

Economic evaluation of quota allocation and transfer methods for supply managed commodities

The procedures of supply-management programs for quota allocation and transfer have major effects on the efficiency and distributional impacts of these programs. The objectives of this project are to:

1. Document and assess the economic effects of existing allocation and transfer methods.
2. Assess the economic effects of alternative allocation and transfer methods.
3. Recommend changes to improve efficiency and equity of current allocation and transfer methods.

SOIL SCIENCE

CROWN, P.H.

Extraction of soil/crop information from digital radar data

To assess the degree to which useful soil/crop information may be extracted from digital radar data for the Raymond test site in southern Alberta. Imaging radar systems on satellites may provide reliable information for crop inventory, monitoring crop and soil moisture conditions, and assessing soil erosion and salinity, when clouds prevent imaging by more conventional satellite systems. In 1990 Canada will launch a satellite with an imaging Radar system.

DUDAS, M.J.; S. PAWLUK; T.B. GOH

Physical-chemical effects of nitrogen fertilizers on soils

The objective is to determine the effects of ammonium-based fertilizers on basic soil chemistry, mineralogy, and micromorphology particularly in relation to soil acidification and alkalization, nutrient imbalances, nitrogen fixation by clays, and deterioration of soil structure attendant with various soil fertilizer application schemes (banding, nesting, broadcast). The studies will focus on the fertilizer-soil solution-soil solid interactions to evaluate hydrolysis reactions and their pH effects on macro and micronutrient chemistry, adsorption reactions leading to mineral fixation of NH_4+ and ligand exchange involving PO_4-3, and aggregate stability and dispersion. These studies will identify/quantify the suspected detrimental effects of N-fertilization and will provide a basis for recommending appropriate rates and types of application to optimize the benefits of fertilization while maintaining soil quality.

NYBORG, M.P.

A study of fall-applied nitrogen: timing of soil test for nitrogen, incorporation, and banding

The objectives are to find: 1) how early in the fall soil sampling for the soil test for nitrogen can be performed without substantially reducing the accuracy of the soil test, and to determine 2) the efficiency of fertilizer nitrogen when placed in bands applied in the early fall as compared to the late fall. The ability of early soil samples to give reliable predictions of the fertilizer nitrogen needs, and the efficiency of early-applied band nitrogen fertilizer, are now topics of controversy in the prairie provinces.

ROBERTSON, J.A.

Recovery of residual potassium from previous, high plowdown applications

The objective of this project is to determine the feasibility of supplying potassium by infrequent, high application rather than lower, annual applications. While the occurrence of potassium deficient soils in Alberta is relatively small, where they do occur large yield increases and improved quality of grain are obtained by applying potassium fertilizers. The common practice has been to make annual broadcast or in-row applications but farmers and fertilizer dealers have questioned the feasibility of higher, less frequent applications. The answer to this question depends upon soil mineralogy and interaction of fertilizer-K with soil components.

INTERDISCIPLINARY

YOUNG, B.A.; J.J. LEONARD; J.B. McQUITTY; W.G. EVANS

Thermodynamics in overwintering bee colonies

The objectives are: to obtain quantitative measures of conductive and ventilation heat losses from overwintering bee hives, and to evaluate the influence of magnitude and route of heat loss on colony strength and overwintering success.

Alberta beekeepers require this basic data to improve their overwintering practices and to gain the considerable economic advantage of successful overwintering. New hives imported in the spring not only have lower potential productivity than overwintered hives but also presently costs the province over two million dollars annually.

VETERINARY MEDICINE

MAPLETOFT, R.J.

Active immunization against GnRH as a replacement for surgical castration in beef cattle

The overall goal of this proposed research is to develop an active immunization regime directed against animal hormones (specifically GnRH, Gonadotropin Releasing Hormone) which can be used as an alternative to surgical castration in cattle. The effects of the vaccine would be to render an animal sexually incompetent and to eliminate sexual behavior by reducing androgen levels; a treated animal could be thought of as an "immunological castrate". In addition vaccinated animals are expected to retain favorable growth rates when compared to surgically castrated animals because low levels of growth promoting androgens will persist. A treatment which combines the behavioral advantages of the intact animal, as well as eliminates the need for surgery, is expected to be of considerable economic value in beef production.

NAYLOR, J.M.

Copper supplementation to beef cows during the winter and summer feeding periods

Copper deficiency is a major problem in cattle in Alberta and Saskatchewan. This project will investigate the effects of copper deficiency on calf host defense mechanisms and disease susceptibility. The affect on growth rate will also be studied. The value of copper supplementation through the feed, or by injection, will be demonstrated.

CONTRIBUTIONS from sources listed are gratefully acknowledged April 1, 1985 - March 31, 1986:

Alberta Dehy Association
Alberta Pork Producers Marketing Board
Alberta Wheat Pool
Canadian Mink Breeders Association
Canola Council of Canada
Chembiomed Ltd.
Cominco Ltd.
Esso Resources Canada Ltd.
George Cringle-Palm Dairies Research Foundation
I & S Produce Ltd.
Potash and Phosphate Institute
Potash Corporation of Saskatchewan
Westbridge Research Group
Western Co-operative Fertilizers
Western Hog Growers Association

ALBERTA AGRICULTURAL RESEARCH TRUST
FINANCIAL STATEMENTS
MARCH 31, 1986

Auditor's Report
Balance Sheet
Statement of Revenue, Expenditure and Unexpended Funds
Notes to the Financial Statements

ALBERTA LEGISLATURE

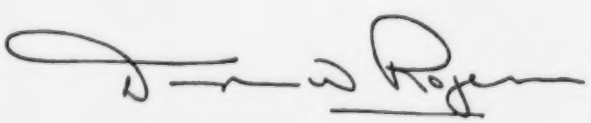
OFFICE OF THE AUDITOR GENERAL

AUDITOR'S REPORT

To the Trustees of the
Alberta Agricultural Research Trust

I have examined the balance sheet of the Alberta Agricultural Research Trust as at March 31, 1986 and the statement of revenue, expenditure and unexpended funds for the year then ended. My examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as I considered necessary in the circumstances.

In my opinion, these financial statements present fairly the financial position of the Trust as at March 31, 1986 and the results of its operations for the year then ended in accordance with generally accepted accounting principles applied on a basis consistent with that of the preceding year.



C.A.
Auditor General

Edmonton, Alberta
August 22, 1986

Statement A

ALBERTA AGRICULTURAL RESEARCH TRUST
BALANCE SHEET
AS AT MARCH 31, 1986

	1986	*1985*
ASSETS		
Current:		
Cash	$355,023	$260,909
Research grants recoverable	5,000	—
	$360,023	$260,909
LIABILITIES AND UNEXPENDED FUNDS		
Current:		
Research grants payable	$145,412	$ 36,026
Administration charges payable	8,293	2,710
Unexpended funds	206,318	222,173
	$360,023	$260,909

The accompanying notes are part
of these financial statments.

ALBERTA AGRICULTURAL RESEARCH TRUST
STATEMENT OF REVENUE, EXPENDITURE AND UNEXPENDED FUNDS
FOR THE YEAR ENDED MARCH 31, 1986

	1986	*1985*
REVENUE		
Contributions from the Province of Alberta, Department of Agriculture	$250,000	$250,000
Contributions from industry (Note 3)	180,906	181,802
Interest	38,453	37,230
	469,359	469,032
EXPENDITURE		
Research grants	447,192	404,511
Administration charge	38,022	26,463
	485,214	430,974
Excess of revenue over expenditure	(15,855)	38,058
Unexpended funds at beginning of year	222,173	184,115
Unexpended funds at end of year	$206,318	$222,173

Note 1 Authority

The Alberta Research Trust operates under the authority of the Alberta Research Trust Act, Chapter A-14, Revised Statutes of Alberta 1980.

Note 2 Significant Accounting Policies

Research Grants

Research grants are recorded in these financial statements when approved for payment to researchers accounts. Unexpended balances of grant funds held in researchers accounts are not reflected in these financial statements.

Changes in Financial Position

A statement of changes in financial position is not provided as disclosure in these financial statements is considered to be adequate.

Note 3 Contributions from Industry

Contributions from industry represent only cash donations to the Trust for specific research projects and are payable out of the Trust as research grants expenditure of the year.

Note 4 Approval of Financial Statemnnts

The financial statements were approved by management.